International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 2017 vol.17 N62, pages 955-960

The method of astronomical refraction anomalies analysis based on aerological data

Demin S., Andreev A., Demina N., Nefedyev Y.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© SGEM2017 All Rights Reserved. The aim of this article is to study astronomical refraction anomalies. Back in 1925 Grachev and Banahevich found systematic errors in meridian observations depending on zenithal distance. Grachev suggested that these refraction anomalies arise from the inclination of the Earth's surface to the South. The airstratas of the same density were considered as parallel to the Earth's surface. But the analysis of latitude observations from the Bamberg and ZTL-180 telescopes showed there were significant systematic errors depending on zenithal distance and we suggested that these errors depended on inclination of the airstratas of the same density, which were independent of inclination of the Earth's surface. As a result, the method of calculating the inclinations of airstratas of the same density has been developed on the basis of aerological data. With this purpose isobaric surfaces (the surfaces of the same atmospheric pressure) in many points of the Earth's surface were taken. Altitudes of each isobaric surface relative to the geoid were analyzed. It was found the impact of inclination of upper air layers of the same density on the refraction does not fully compensate the impact of inclination of lower atmospheric boundary layers. If inclination of the upper air layers starts from small altitude, then the impact of inclination of the lower atmospheric boundary layers on the refraction compensate approximately 50 % of the impact of inclination of the upper atmospheric boundary layers on the refraction. Therefore, it is necessary to introduce amendments to observations of refraction anomalies due to the impact of inclination of air layers of the same density; those amendments are particularly important for making observations by modern high-sensitive telescopes. Thus, if a pair of stars on different sides of the zenith is observed for example at zenithal distance of 70°, then the error in the latitude for anomalous refraction due to inclination of atmospheric boundary layers is about 0.1'. The present investigation allows explaining systematic differences between Hipparcos and modern star catalogues.

http://dx.doi.org/10.5593/sgem2017/62/S28.122

Keywords

Astrometry, Refraction anomalies, Star catalogues

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